

## REMARKS

The outstanding Action dated May 19, 2003 has been received and carefully noted. The above amendments and the following remarks are submitted as a full and complete response thereto. By this Amendment, claims 1, 3/1 and 4/3/1 have been further amended to more particularly point out and distinctly claim the invention. No new matter has been added. Claim 8 is newly added. The amendments to claim 1 are supported generally by the original disclosure at page 10, lines 4-5. Claim 8 is supported generally at page 3, lines 11-12. Currently claims 1-8 are pending with claims 2, 3/2, 4/3/2 and 5-7 withdrawn from consideration. Accordingly, claims 1, 3/1, 4/3/1 and 8 are submitted for consideration.

Claim 4/3/1 was rejected under 35 U.S.C. §112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Specifically, the outstanding Action took the position that when the offset  $\underline{a}$  is 0, this should no longer be considered to be an offset. However, upon review of Applicants' specification at pages 22-24 and 25, for example, the specific results of when the offset  $\underline{a}$  is 0 are explained. For example, at page 22, it is stated that when the offset  $\underline{a}$  of the dielectric material D is 0, the sizes  $d_1$  and  $d_2$  of the first and second gaps G1 and G2 on either side of the dielectric material D are both  $d/2$ . Furthermore, Tables 7, 8, 9 and 10 also illustrate test conditions and test results when offset  $\underline{a}$  is 0. Please confirm whether our understanding of this is correct.

Therefore, withdrawal of the rejection is respectfully requested.

Claim 4/3/1 was rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. In making this rejection, the outstanding Action took the position that the amount a lacks antecedent basis and that the terms a and d are not defined.

Firstly, claims 1 and 4 have further been amended to more particularly point out and distinctly claim the invention. Secondly, the claim itself defines a to be the offset. Thirdly, as discussed above, Applicants' specification clearly discusses the specific test results that occur when the offset a is equal to 0.

Therefore, Applicants respectfully request that the rejection be withdrawn.

Claims 1, 3/1 and 4/3/1 have been rejected under 35 U.S.C. §102(b) as being anticipated by or obvious over Conrad (U.S. Patent No. 5,211,919). In making this rejection, the outstanding Action took the position that Conrad discloses all the elements of the claimed invention. However, Applicants submit that the subject matter of claims 1, 3/1 and 4/3/1 is neither disclosed nor suggested in the cited art.

Applicants' amended Claim 1 recites a plasma reactor comprising a pair of electrodes facing each other. A dielectric material is positioned between the pair of electrodes and a gap d is formed between at least one of the electrodes and the dielectric material. An electrical power supply is provided for applying an alternating or pulsed current to the pair of electrodes, and generating a plasma in a gas passing through the gap between the pair of electrodes to thereby modify the gas. The average current density  $I_{rd}$  of the plasma thus generated satisfies the formula  $10^{-4} \text{ A/cm}^2 \leq I_{rd} \leq 10^{-1} \text{ A/cm}^2$ . The average current density  $I_{rd}$  is the range where a concentrated discharge and a barrier discharge are simultaneously generated.

The outstanding Action took the position that Conrad's cell comprises all the structure elements of the claimed invention except for the method of operating the cell. However, it is respectfully submitted that the prior art fails to disclose or suggest the structure of the claimed invention, and therefore, fails to provide the advantages of the present invention. For example, the plasma reactor of the present invention is configured such that the average current density  $I_{rd}$  of the plasma thus generated satisfies the formula

$$10^{-4} \text{ A/cm}^2 \leq I_{rd} \leq 10^{-1} \text{ A/cm}^2.$$

As a result of the claimed configuration, a concentrated discharge and a barrier discharge are simultaneously generated by setting the average current density  $I_{rd}$  of the plasma lower than the average current density  $I_{rd}$  of an ordinary concentrated discharge, and higher than the average current density  $I_{rd}$  of an ordinary barrier discharge. Thus, a plasma having an adequate average current density  $I_{rd}$  sufficient for carrying out efficient modification of the gas can be generated over the whole region between the pair of electrodes. Moreover, since the upper limit of the average current density  $I_{rd}$  is controlled, it is possible to prevent damage to the dielectric material due to an excessive average current density  $I_{rd}$  and to prevent any increase in the load on the electrical power supply.

Conrad discloses a front plate corona cell for generating ozone. Fig. 1 shows first conductive electroplate 12, housing/shell 14 and isolator plate functioning at the second conductive electrode 16. Fig. 2A illustrates that the first conductive electroplate 12 is positioned adjacent dielectric plate 28 and second conductive electroplate 30.

Although the outstanding Action took the position that Conrad discloses all the elements of the claimed invention, upon review of Conrad, among other things, Conrad

fails to disclose or suggest that the average current density "I<sub>rd</sub>" of the plasma generated satisfies the formula  $10^{-4} \text{ A/cm}^2 \leq I_{rd} \leq 10^{-1} \text{ A/cm}^2$  as recited in claim 1. As disclosed generally in Applicants' specification at page 10, for example, the average current density I<sub>rd</sub> is the value obtained by dividing the effective current I<sub>rms</sub> flowing in the plasma reactor by the discharge area S<sub>d</sub> where the discharge actually occurs. Conrad also fails to disclose or suggest that the average current density I<sub>rd</sub> is the range where a concentrated discharge and a barrier discharge are simultaneously generated, as further recited in claim 1.

Furthermore, regarding claim 4, Conrad fails to disclose or suggest that the amount a that the center of the dielectric material in the width direction is offset from the midpoint of the distance between the pair of electrodes satisfies the formula  $0 \leq a \leq 0.5 \times (d / 2)$ .

Applicants' specification at page 6, for example, clearly discloses that setting the amount a such that the center of the dielectric material in the width direction is offset from the midpoint of the distance between the pair of electrodes in a predetermined range ensures that the gap between the dielectric material and one of the electrodes is larger than a minimum size. Furthermore, the predetermined range prevents the modification efficiency from being degraded due to gas having difficulty passing through the gap.

Still further, although the outstanding Action took the position that it would have been obvious to one having ordinary skill in the art to modify Conrad because it has been held that the manner in which the apparatus operates is not germane to the issue of patentability, the Applicants respectfully disagree. Firstly, Conrad fails to disclose or suggest the specific formula recited for the average current density in claim 1 of the

present invention. Secondly, assuming *arguendo*, that Conrad does teach an average current density, in addition to the advantages already discussed above, Applicants' specification further discloses generally at page 11, that at the claimed average current density, the input voltage is reduced, thus easing the load on the electrical supply power P, and the reduction in the size of the power source makes it easier to install the plasma reactor in a vehicle where space efficiency is required.

Therefore, it is respectfully submitted that the Applicants' invention, as set forth in claims 1, 3/1 and 4/3/1 is not anticipated within the meaning of 35 U.S.C. § 102 and nonobvious within the meaning of 35 U.S.C. § 103.

Claims 1, 3/1 and 4/3/1 have been rejected under 35 U.S.C. §102(b) as being anticipated by Kamiya et al. (U.S. Patent No. 5,549,874, "Kamiya") and have been rejected under 35 U.S.C. §103(a) as being obvious over Kamiya. However, Applicants submit that the subject matter of claims 1, 3/1 and 4/3/1 is neither disclosed nor suggested in the cited art.

Kamiya's invention is directed to a discharge reactor. As shown in Figs. 1-5, 2 is a dielectric, 3 is a high voltage electrode, 4 is a grounded electrode and 7 is a high voltage power supply that is connected to high voltage electrode 3 and grounded electrode 4, and applies high AC voltage to produce discharge in the space 1.

As discussed above with respect to Conrad, although the outstanding Action took the position that Kamiya discloses all the elements of the claimed invention, upon review of Kamiya, among other things, Kamiya fails to disclose or suggest that the average current density "I<sub>rd</sub>" of the plasma generated satisfies the formula  $10^{-4} \text{ A/cm}^2 \leq \text{Ird} \leq 10^{-1} \text{ A/cm}^2$ , as recited in claim 1, or that the average current density I<sub>rd</sub> is in the range where a concentrated discharge and a barrier discharge are simultaneously

generated, as further recited in claim 1, or that the amount  $a$  that the center of the dielectric material in the width direction is offset from the midpoint of the distance between the pair of electrodes satisfies the formula  $0 \leq a \leq 0.5 \times (d / 2)$ , as recited in claim 4.

Therefore, it is respectfully submitted that the Applicants' invention, as set forth in claims 1, 3/1 and 4/3/1, is neither anticipated nor obvious within the meaning of 35 U.S.C. §§ 102 and 103, respectively.

Claims 1, 3/1 and 4/3/1 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Duarte (U.S. Patent No. 5,554,344) in view of Kamiya. In making this rejection, the outstanding Action took the position that Duarte discloses all the elements of the claimed invention, except for a specific type power source. Kamiya was cited for disclosing this limitation. However, Applicants submit that the subject matter of claims 1, 3/1 and 4/3/1 is neither disclosed nor suggested in any combination of the cited art.

Duarte's invention is directed to a gas ionization device that comprises a pair of electrodes 4, 5 and a dielectric material 3 positioned between the pair of electrodes.

As discussed above with respect to Conrad and Kamiya, although the outstanding Action took the position that Duarte, as modified by Kamiya, discloses all the elements of the claimed invention, upon review of Kamiya, among other things, Duarte or Kamiya, either alone or in combination fail to disclose or suggest that the average current density "Ird" of the plasma generated satisfies the formula  $10^{-4} \text{ A/cm}^2 \leq \text{Ird} \leq 10^{-1} \text{ A/cm}^2$ , as recited in claim 1, or that the average current density Ird is the range where a concentrated discharge and a barrier discharge are simultaneously generated, as also recited in claim 1, or that the amount  $a$  that the center of the dielectric material in the width direction is offset from the midpoint of the distance

between the pair of electrodes satisfies the formula  $0 \leq a \leq 0.5 \times (d / 2)$ , as recited in claim 4.

Therefore, it is respectfully submitted that the Applicants' invention, as set forth in claims 1, 3/1 and 4/3/1 is not obvious within the meaning of 35 U.S.C. § 103.

In view of the foregoing, reconsideration of the application, withdrawal of the outstanding rejections, allowance of claims 1, 3/1, 4/3/1, and 8, and the prompt issuance of a Notice of Allowability are respectfully solicited.

If this application is not in condition for allowance, the Examiner is requested to contact the undersigned at the telephone listed below.

In the event this paper is not considered to be timely filed, the Applicants respectfully petition for an appropriate extension of time. Any fees for such an extension, together with any additional fees that may be due with respect to this paper, may be charged to counsel's Deposit Account No. 01-2300, **referencing docket number 107348-00102.**

Respectfully submitted,  
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Enclosure: Petition for Extension of Time (2 months)

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